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Review of a bachelor thesis of Mr. Maksym Ivashechkin (*posudek oponenta*)

Improved USAC / USAC++

This bachelor thesis deals with a family of RANSAC-like algorithms used for robust geometrical model estimation. This is indeed an important practical problem. As far as I understood, the main part of the student's work was the integration of two new RANSAC-like methods (Graph-Cut RANSAC and NAPSAC) into an existing USAC (universal framework RANSAC) library. Unfortunately, I found it rather difficult to evaluate this part of the work. A code was provided with the bachelor thesis but I could not find any documentation for it and the comments in the source code are also rather sparse. Most importantly, it is not clear, what part of the submitted code was actually written by the candidate and what is the relation of the submitted code to existing implementations of RANSAC-like algorithms. I could not find the candidate's name in any of the source code files.

The Introduction (Chapters 1 to 3) is short but well written. A very large part of the text (Chapters 4 to 9) describes various aspects of existing RANSAC-like methods. Their description is adequate but not sufficient to serve as a sole, self-contained reference. Terms are sometimes used before being defined.

Chapter 10 contains some comments about the implementation choices. Only about 4 pages of the text are dedicated to candidate's own work. In Section 10.3., the candidate appears to suggest an alternative way of defining quality of correspondences in PROSAC, called 'dense sort', based on the assumptions that true matches (inliers) are close to each other. Chapter 11 describes experiments: Section 11.2 compares PCA, QR decomposition and SVD for homography estimation, and Section 11.3 describes a single experiment comparing the different RANSAC-like methods. We see that the experimental part is also rather short, with basically just a single main experiment. I would appreciate studying the influence of changing the different building blocks and changing the parameters.

From the language point of view, the English could often be improved but the text remains understandable. Typographic quality is very good. Some images are too small (e.g. Figure 11.1b).

To conclude, I believe that the main contribution of this thesis was the implementation of the different RANSAC-like algorithms. Unfortunately, it is hard to judge the amount and quality of this work from the provided materials. **I recommend this thesis to be defended and I propose the grade "C (Good/dobře)".**

Jan Kybic

Questions and comments:

1. Did you write the submitted code yourself, completely from scratch or is it based on an existing code? If so, please provide details.
2. Did you compare your implementation with other available implementations?
3. You wrote on page 32 that points are neighbors if they are in the same cells. However, neighbors can be not only in the same cells but also in the neighboring cells.
4. Can you explain equation 10.3.? As far as I understand it, the coordinates \mathbf{x} and \mathbf{x}' are in two different coordinate systems of the two images, so why does it make sense to calculate the intersection of their neighborhoods?
5. Can you quantify the improvement thanks to using a non-standard random number generator?